

LOGISTIC REGRESSION USED IN DETERMINING THE FACTORS THAT INFLUENCE THE PERCEPTIONS ON LIFE SATISFACTION IN CENTRAL AND EASTERN EUROPE

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Abstract:

This study focuses on an analysis of the relationship between the perceptions on life satisfaction and several socio-demographic factors for Central and Eastern-European countries. The data used for analysis was selected from the Eurobarometer 2011 results. The Eurobarometer is a survey conducted periodically by the European Commission, designed to help understand various dimensions of the social, economic and political strategies, as well as future EU policies. The selected Eurobarometer data is modelled using multinomial logistic regression, each potential predictor being assessed regarding its impact on the declared level of life satisfaction.

Keywords: life satisfaction, multinomial logistic regression, regression coefficients, odds ratio

JEL codes: C - Mathematical and Quantitative Methods; C0 - General – C01 – Econometrics; C5 - Econometric Modeling

Introduction

Life satisfaction is a multi-dimensional indicator connected with the political, economical and social life of each country. Life satisfaction has a quite volatile formula depending on several factors and above all on the specificity of each individual.

An overview of the literature exploring the well-being and life satisfaction shows two main areas of study: individual factors that influence the level of life satisfaction and country-level factors that can help conduct comparative studies among different states. Life satisfaction studies from various countries highlight a consensus for the determinants of life satisfaction at an individual level (Oswald, 1997, Frey and Stutzer, 2002, Diener and Seligman, 2004; Hayo, 2004; Bjørnskov, Dreher and Fischer, 2008): income, the general socio-economic status (Frijters et al, 2004), education, unemployment, age, health, faith (Clark and Lelkes, 2005) and marital status are strongly correlated with life satisfaction. On the other side, national income, institutional, political and cultural factors influence life satisfaction at the country level, but there does not seem to a perfect uniformity between the various country studies and the corresponding results.

Veenhoven (1989) believes that life satisfaction is the extent to which individuals evaluate their "life as a whole". Just like Aristotle (Nicomachean Ethics, 1988), we believe there doesn't exist one single model of reaching happiness, nor a unique form of its manifestation. A high level of welfare, satisfaction with life in general is determined by the specificity of each individual. The contemporary literature (Kroll, 2011) comes back to the idea that different things can make different people happy, hence happiness does not hold an "unitary formula".

Our study focuses on analyzing the relationship between perceptions on life satisfaction and several socio-demographic factors for Central and Eastern-European countries. Our aim is to determine some of the predictors for reaching satisfaction with life based on the specificity of the central and eastern European region. The data is modelled using logistic regression, each predictor being assessed regarding its impact on the declared level of life satisfaction.

1. Data and method

Based on the idea initiated by Aristotle, we believe there is no exclusive “model” of reaching happiness. We assess, therefore, the relationship between life satisfaction and several potential predictors in Central and Eastern Europe such as country of residence, health status, living conditions, personal relations status, gender, and marital status to determine those significant for our model.

In the analysis we used a dataset from the 76.2 Eurobarometer carried out in September-November 2011. This survey presents opinions and data on the topic of employment and social policy such as: economic crisis and employment situation, job mobility, current and future personal employment situation, economic crisis impact on social justice, poverty experience, satisfaction with different areas of life (European Commission, 2012). Launched and organized periodically by the Commission, the survey is designed to better understand the various dimensions of social, economic, political, strategies and future EU policies.

The focus of this study is the relationship and association between perceptions on life satisfaction and several predictors for individuals residing Central and South Eastern countries of Europe.

Out of the 31.280 citizens that were interviewed we selected only those respondents residing in Bulgaria, Czech Republic, Poland, Romania, Slovakia, Slovenia, Croatia, and Republic of Macedonia. The responses add up to a number of 8067.

The response variable is satisfaction with life in general, a multinomial variable, originally encoded on a scale from 1 (very dissatisfied) – 10 (very satisfied), was recoded into three categories:

Life Satisfaction: {1 - 'Dissatisfied', 2 - 'Somewhat Satisfied', 3- 'Satisfied' }

The predictors (independent variables) are country, health satisfaction, personal relations satisfaction, living conditions satisfaction, gender, and marital status with the following categories:

Country: {31 - 'Bulgaria', 33 - 'Czech Republic', 39 – 'Poland', 40 – 'Romania', 41 – 'Slovakia', 42 – 'Slovenia', 46 - 'Croatia', 63 - 'Republic of Macedonia' }

Health satisfaction: {1 - 'Dissatisfied', 2 - 'Somewhat Satisfied', 3- 'Satisfied', 99 – NA/DK }

Personal Relations satisfaction: (1 - 'Dissatisfied', 2 - 'Somewhat Satisfied', 3- 'Satisfied', 99 – NA/DK}

Living conditions satisfaction: {1 - 'Dissatisfied', 2 - 'Somewhat Satisfied', 3- 'Satisfied', 99 – NA/DK}

Gender: {1 – Male, 2 - Female}

Marital Status: {1 – Unmarried, 2 - (Re) Married/Single with a partner, 3 - Divorced or separated, 4 – Widowed, 99 –NA/ DK}

The multinomial logistic regression model is used due to the fact that the dependent variable has more than two categories. The logit for each non-reference category j against the reference category 1 depends on the values of the explanatory variables through the model:

$$\log\left(\frac{P(y = j)}{P(y = c)}\right) = \beta_{0j} + \beta_{ij}x_{ij} + \varepsilon \quad , j = 1, \dots, c-1; i = 0, \dots, k \quad (1)$$

The logistic models for multinomial dependent variable use all pairs of categories by specifying the odds of outcome in one category instead of another. Modelling the data with multinomial logistic regression we will analyze the relationship between life satisfaction and several predictors: country, health satisfaction, personal relations satisfaction, living conditions satisfaction, gender, and marital status.

2. Empirical results

2.1 Descriptive Statistics

49% of the respondents answered that they are satisfied with their lives while 12 % are not satisfied. The same percent of individuals declared that they are satisfied with their health.

Satisfaction regarding personal relations and living conditions is 64%, and 46%, respectively. From the point of view of marital status, 64% are married or they have a partner, and the rest are single, divorced or widowed. The respondents are quite equally split among the seven countries: residents of Bulgaria, Slovenia and Republic of Macedonia sum up each to 13%, while residents from the other 4 countries (Czech Republic, Poland, Slovakia, Croatia) sum up each to 12%.

2.2 The multinomial logistic regression model for life satisfaction

We aim our regression model to provide information about the importance of the independent variables in differentiating the categories of the response variable.

To estimate the relationship between life satisfaction and the independent (predicting) variables we use the “mlogit” R function (multinomial logit model), a function that performs an estimation by maximum likelihood of the multinomial logit model, with alternative-specific and/or individual specific variables; our data contains only individual specific variables: country, health satisfaction, personal relations satisfaction, living conditions satisfaction, gender, and marital status.

The likelihood of the model is used to test whether all predictors’ regression coefficients in the model are simultaneously zero. The value of Log-Likelihood is -4532,7. The Likelihood Ratio Chi-Square value helps assess the model fit and it is 6633.6 with the p-value = < 2.22e-16. The small p-value would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero.

The overall test of the relationship among the independent variables and groups defined by the dependent variable is based on the reduction in the likelihood values for a model which does not contain any independent variables and the model that contains the independent variables. Table 1 presents the estimated multinomial logistic regression coefficients for the models, the standard errors of the individual regression coefficients for the two estimated models, t-values that test the null hypothesis that the estimate equals 0, p-values of the coefficients, significance and the odds ratios for the predictors.

Table 1: The estimated multinomial logistic regression coefficients

Coefficients	Estimate	Std. Error	t-value	Pr(> t)	Significance	Exp(coefficients)
2:(intercept)	-3,40546	0,23607	-14,4254	< 2.2e-16	***	3,3192E-02
3:(intercept)	-7,27658	0,37684	-19,3097	< 2.2e-16	***	6,9155E-04
2:Country33	0,97461	0,2016	4,8345	1,335E-06	***	2,6501E+00
3:Country33	1,41376	0,22412	6,3081	2,826E-10	***	4,1114E+00
2:Country39	0,78111	0,17648	4,426	9,601E-06	***	2,1839E+00
3:Country39	1,37476	0,20417	6,7333	1,659E-11	***	3,9541E+00

2:Country40	0,58128	0,18238	3,1872	0,0014367	**	1,7883E+00
3:Country40	1,03376	0,21049	4,9113	9,047E-07	***	2,8116E+00
2:Country41	1,05558	0,1952	5,4075	6,389E-08	***	2,8736E+00
3:Country41	1,46126	0,22013	6,6381	3,178E-11	***	4,3114E+00
2:Country42	1,13005	0,22479	5,0273	4,975E-07	***	3,0958E+00
3:Country42	1,83111	0,24612	7,44	1,006E-13	***	6,2408E+00
2:Country46	0,59515	0,17907	3,3236	0,0008887	***	1,8133E+00
3:Country46	1,29802	0,20486	6,3361	2,357E-10	***	3,6620E+00
2:Country63	0,40568	0,1711	2,371	0,017741	*	1,5003E+00
3:Country63	0,69064	0,20249	3,4107	0,0006479	***	1,9950E+00
2:HealthSat2	1,24018	0,11221	11,0522	< 2.2e-16	***	3,4562E+00
3:HealthSat2	1,64213	0,14821	11,0797	< 2.2e-16	***	5,1662E+00
2:HealthSat3	1,3498	0,13984	9,6525	< 2.2e-16	***	3,8567E+00
3:HealthSat3	2,81939	0,16531	17,0557	< 2.2e-16	***	1,6767E+01
2:HealthSat99	0,25807	0,99734	0,2588	0,7958255		1,2944E+00
3:HealthSat99	0,39837	1,27691	0,312	0,7550551		1,4894E+00
2:PersRelSat2	1,86207	0,14623	12,7338	< 2.2e-16	***	6,4370E+00
3:PersRelSat2	2,08099	0,28348	7,3408	2,123E-13	***	8,0124E+00
2:PersRelSat3	1,84869	0,15615	11,8389	< 2.2e-16	***	6,3515E+00
3:PersRelSat3	3,78858	0,28062	13,5006	< 2.2e-16	***	4,4194E+01
2:PersRelSat99	1,64256	0,40142	4,0919	4,278E-05	***	5,1684E+00
3:PersRelSat99	2,94302	0,51566	5,7072	1,148E-08	***	1,8973E+01
2:LivCondSat2	2,41206	0,10646	22,657	< 2.2e-16	***	1,1157E+01
3:LivCondSat2	2,96756	0,16505	17,9795	< 2.2e-16	***	1,9444E+01
2:LivCondSat3	2,6223	0,17444	15,0324	< 2.2e-16	***	1,3767E+01
3:LivCondSat3	5,10479	0,20788	24,5569	< 2.2e-16	***	1,6481E+02
2:LivCondSat99	-0,4389	1,22731	-0,3576	0,7206316		6,4475E-01
3:LivCondSat99	3,10247	0,93591	3,3149	0,0009167	***	2,2253E+01
2:Gender2	-0,20613	0,10326	-1,9963	0,0459039	*	8,1373E-01
3:Gender2	-0,11478	0,11533	-0,9952	0,3196533		8,9156E-01
2:MarStatus2	0,28629	0,15915	1,7988	0,0720432	.	1,3315E+00
3:MarStatus2	0,06832	0,172	0,3972	0,6912061		1,0707E+00
2:MarStatus3	0,05739	0,22324	0,2571	0,7971189		1,0591E+00
3:MarStatus3	-0,77738	0,25796	-3,0136	0,0025818	**	4,5961E-01
2:MarStatus4	0,14969	0,19167	0,781	0,4348115		1,1615E+00
3:MarStatus4	-0,40946	0,21957	-1,8648	0,0622071	.	6,6401E-01
2:MarStatus99	0,17924	0,44441	0,4033	0,6867163		1,1963E+00
3:MarStatus99	0,27423	0,46843	0,5854	0,5582638		1,3155E+00

Source: Eurobarometer 76.2 data modeled with R

According to the p-values of the coefficients' estimates, the significant predictors for the model are: country, health satisfaction, personal relations satisfaction, living conditions satisfaction, one category of gender and one category of marital status.

For life satisfaction category “satisfied” relative to “dissatisfied” the Wald test statistic for the predictor **health satisfaction** – “satisfied” is 17.0557 with an associated p-value of less than 2.2e-16. If a subject were to modify the health satisfaction level from “dissatisfied” to “satisfied” we would expect him/her to be more likely satisfied than dissatisfied with life.

For life satisfaction category “satisfied” relative to “dissatisfied” the Wald test statistic for the predictor **personal relations satisfaction** – “satisfied” is 13,5006 with an associated p-value of less than 2.2e-16. If a subject were to modify the personal relations satisfaction level from “dissatisfied” to “satisfied” we would expect him/her to be more likely satisfied than dissatisfied with life.

For life satisfaction category “satisfied” relative to “dissatisfied” the Wald test statistic for the predictor **living conditions satisfaction** – “satisfied” is 24,5569 with an associated p-value of less than 2.2e-16. If a subject were to modify the living conditions satisfaction level from “dissatisfied” to “satisfied” we would expect him/her to be more likely satisfied than dissatisfied with life.

According to the significance of each category of the independent variable (Table 1: significant predictors have p-values < 0,05) the resulting model equations are as follows (the reference category of the Dependent Variable is Life Satisfaction =”1”). Maximum likelihood estimates determine the effect for all pairs of categories. In the three outcome category model there are two logit functions.

$$\log\left(\frac{P(LifeSat = 2)}{P(LifeSat = 1)}\right) = -3,40546$$

$$+ 0,97461 * (Czech Rep) + 0,78111 * (Poland) + 0,58128 * (Romania) + 1,05558 * (Slovenia)$$

$$+ 1,13005 * (Slovakia) + 0,59515 * (Croatia) + 0,40568 * (Macedonia)$$

$$+ 1,24018 * (HealthSat = 2) + 1,3498 * (HealthSat = 3)$$

$$+ 1,86207 * (PersRelSa t = 2) + 1,84869 * (PersRelSa t = 3)$$

$$+ 2,41206 * (LivCondSa t = 2) + 2,6223 * (LivCondSa t = 3) - 0,20613 * (Gender = 2)$$

(2)

$$\log\left(\frac{P(\text{LifeSat} = 3)}{P(\text{LifeSat} = 1)}\right) = -7,27658$$

$$+ 1,41376 * (\text{Czech Rep}) + 1,37476 * (\text{Poland}) + 1,03376 * (\text{Romania}) + 1,46126 * (\text{Slovenia})$$

$$+ 1,83111 * (\text{Slovakia}) + 1,29802 * (\text{Croatia}) + 0,69064 * (\text{Macedonia})$$

$$+ 1,64213 * (\text{HealthSat} = 2) + 2,81939 * (\text{HealthSat} = 3)$$

$$+ 2,08099 * (\text{PersRelSat} = 2) + 3,78858 * (\text{PersRelSat} = 3)$$

$$+ 2,96756 * (\text{LivCondSat} = 2) + 5,10479 * (\text{LivCondSat} = 3) - 0,77738 * (\text{MarStatus} = 3)$$

(3)

In multinomial logistic regression, the interpretation of a parameter estimate's significance is limited to the model in which the parameter estimate was calculated. For a unit change in the predictor variable, the logit of outcome *m* relative to the referent group is expected to change by its respective parameter estimate given the variables in the model are held constant. The outcome measure in this analysis is the life satisfaction and we want to assess its relationships with the country, health satisfaction, personal relations satisfaction, living conditions satisfaction, gender, and marital status.

Conclusion

Our analysis shows that only some of the potential determinants of life satisfaction had significant results. The positive impact of a good health situation, a high status of living conditions, and of personal relations was confirmed: if the satisfaction level would go up for these respondents in Central and Eastern European countries would be more likely to claim they are rather more satisfied than dissatisfied with life in general.

The differences between countries also have an impact on the citizens' level of life satisfaction: different living conditions and different economic statuses surely influence the perception on life satisfaction of those involved. Our analysis comes thus to confirm some of the common sense results related to the factors that could influence the perception on life satisfaction: the country of residence, the health status, personal relations, and living conditions.

In conclusion, life satisfaction is not a one-dimensional indicator, but it relates to many other characteristics, and specific individual elements that need to be taken into account when addressing such topic. Clearly, it is not enough to relate strictly to these results, but that we can

include additional variables to model the level of satisfaction. A next step could be an analysis on several levels that could offer completeness to our conclusions.

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